

# **ASSESSMENT OF RADIATION EXPOSURE TO THE ENVIRONMENT AND NON-HUMAN BIOTA AND ASSOCIATED RISK LINKED WITH LIQUID DISCHARGES FROM THE BELGIAN NUCLEAR POWER PLANTS OF TIHANGE AND DOEL.**

**Background and objective** The need for investigating potential risks induced by radioactive contaminants on wildlife and ecosystems is now internationally recognized. International recommendations and guidelines and a comprehensive system to protect the environment from ionizing radiation are under development and environmental protection benchmarks are being derived<sup>[1-4]</sup>. Ecological or environmental risk assessment (ERA) is an increasingly important component in any decision-making process that aims to provide transparent management decisions on environmental practices and associated problems. In view of future regulation, SCK•CEN has been commissioned by Electrabel (GDF-Suez) to perform an environmental impact and risk assessment resulting from the liquid radioactive discharges from the Belgian Nuclear Power Plants (NPP) of Doel and Tihange.

**Approach** ERA is a multistage process, starting with hazard identification, followed by exposure, effects and risk assessment. Information on discharge data (3 release scenarios: release limits, 10-year maxima and averages) and characteristics of potentially affected biota (reference organisms) were collected. Environmental media concentrations (EMC) and biota concentrations (BC) were assessed following a conservative (box-dilution model) and more realistic approach (Shaeffer model) in assessing the environmental media concentration for the three release scenarios. The ERICA tool<sup>[2]</sup> was used to assess radiation dose rates to the reference organisms and associated risks. Potential impact will be expressed here as a risk quotient (RQ) based on a radiation screening value of 10  $\mu\text{Gy/h}$ . If  $\text{RQ} < 1$ , the environment is unlikely at risk.

**Main results** For the discharge limits (set to protect man),  $\text{RQ} > 1$  were attained both for Doel and Tihange for conservative estimates of the EMC and BC. For more realistic estimates of EMC and BC, all RQs were below one. It could hence be concluded that the liquid radiological discharge limits for the Belgian NPP are set stringent enough to not harm the aquatic and terrestrial environment of Meuse and Scheldt. Since for the different radionuclides considered, actual discharges are comparable to up to 4 orders of magnitude lower than discharge limits, RQs obtained are  $\ll 1$  and the freshwater and terrestrial environment of Meuse and Scheldt is expected not to be harmed by the actual liquid discharges from the Belgian NPP. Also risk assessments based on environmental monitoring data result in  $\text{RQ} < 1$ , with 80-99% of the contribution to the dose rate (and hence RQ) being related to the presence of natural radionuclides.

**References:** [1] IAEA (1992) Effects of Ionizing Radiation on Plants and Animals at levels Implied by Current radiation protection Standards, Technical Reports Series No. 332. [2] Garnier-Laplace, J. and Gilbin, R. (Eds). (2006). Derivation of Predicted No Effect Dose Rate values for ecosystems (and their sub-organisational levels) exposed to radioactive substances. Deliverable D5. European Commission, 6th Framework, Contract N°FI6RCT-2003-508847. [3] ICRP 2008. Environmental protection: the concept and use of reference animals and plants. ICRP-108. Volume 38. [4] UNSCEAR 2008. Effects of ionizing radiation on non-human biota, A/AC.82/R.672.